ANSWERS TO STUDY QUESTIONS

Chapter 27

27.1. A call option is the right without obligation to obtain an underlying asset (such as shares of stock) upon the payment of an exercise (or "strike") price (such as cash).

27.3. The call option model of land value views the value of the land as deriving solely from the development rights provided by the land ownership. The underlying asset is the building or built property that can be obtained by development on the land. The exercise price is the construction cost necessary to develop the project (excluding land cost). The maturity of the option for fee simple land ownership and as-of-right development is effectively infinite making such rights perpetual call options until they are exercised. However, leaseholds (ground leases) and special permit rights may have temporal limits, which make them effectively finite maturity options.

27.5. The arbitrage based derivation of the option value model and the certainty equivalence discounting based derivation both give exactly the same result, and this result is seen to reflect, and indeed to be fundamentally based upon, the precept that the option value should be such that investors in the option, in the underlying asset, and in riskless bonds, all receive the same expected return risk premium per unit of risk in their investment. This is the condition of equilibrium within and across the markets for land (the option), built property (the underlying asset), and construction cost like cash flows (bonds).

27.7. *[The answer to this question can highlight any two of the concepts discussed in section 27.6, including the long-term leasing option effect, the information-based building cascades model, and the strategic exercise phenomenon in the context of competitive developers facing finite building absorption demand.]*

27.9. Value if Developed Today: NPV = \$2,000,000 − \$1,800,000 = \$200,000

Value if Wait a Year: NPV in 1 year = \$2,200,000 − \$1,900,000 = \$300,000. NPV of \$300,000 today @ 25% = 300,000/1.25 = \$240,000.

You should wait and develop next year since \$240,000 > \$200,000.

27.11. a.

$$N = (Cu - Cd)/(Vu - Vd) = (700 - 0)/(2600 - 1800) = 0.875.$$
$$B = (NVd - Cd)/(1 + rf) = ((0.875)1800 - 0)/1.04 = 1575/1.04 = 1514.42.$$
$$\begin{aligned} C &= N(PV(V1)) - B = 0.875(0.5 * 2600 + 0.5 * 1800)/1.085 - 1514.42 \\ &= 0.875(2200/1.085) - 1514.42 = 0.875 * 2027.65 - 1514.42 \\ &= 1774.19 - 1514.42 \\ &= 259.77. \end{aligned}$$

By arbitrage, the land is worth \$259,770.

b.

$$\begin{aligned} C &= (E[C1] - (Cu - Cd)\,(E[rV] - rf)/(Vu/PV(V1) - Vd/PV(V1)))/(1 + rf) \\ &= (350 - (700 - 0)\,(.085 - .04)/(2600/2027.65 - 1800/2027.65))/1.04 \\ &= (350 - 700 * .045/(1.2823 - 0.8877)/1.04 = (350 - 31.50/.3946)/1.04 \\ &= (350 - 79.83)/1.04 = 270.17/1.04 = 259.78. \end{aligned}$$

This is the same as the previous value except for round-off effects. Thus, by certainty-equivalence discounting, the land is worth \$259,780.

c. The implied true OCC of the land is: E[C1] / C − 1 = 350 / 259.77 − 1 = 1.3473 − 1 = 0.3473.

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The OCC of the land is approximately 34.7%, which is quite a bit greater than the 25% rate naively or arbitrarily assumed in 27.10.

*27.13. a. $\eta = \{0.09 - 0.06 + (0.2)^2/2 + [(0.06 - 0.09 - (0.2)^2/2)^2 + 2(0.06)(0.2)^2]^{1/2}\}/(0.2)^2 = 3.386$

$RP_{LAND} = \eta RP_P = 3.386 \times 5.00\% = 16.93\%$

So the expected total return on land is 6.00% + 16.93% = 22.93%.

b. $V^* = K\eta\ /(\eta - 1) = \$800{,}000 \times (3.386/2.386) = \$1{,}135{,}289$

Land Value = $(\$1{,}135{,}289 - \$800{,}000)^*(\$1{,}000{,}000/\$1{,}135{,}289)^{3.386} = \$218{,}187$

c. Hurdle B/C ratio = $\eta/(\eta - 1) = 3.386/2.386 = 1.42$

d. $V^* = K\eta/(\eta - 1) = \$800{,}000 \times (3.386/2.386) = \$1{,}135{,}289$

This is the hurdle value for the built property to trigger immediate development.

e. It's better to wait because the newly developed property would only be worth $1,000,000, which is less than the $1,135,289 required hurdle value.

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